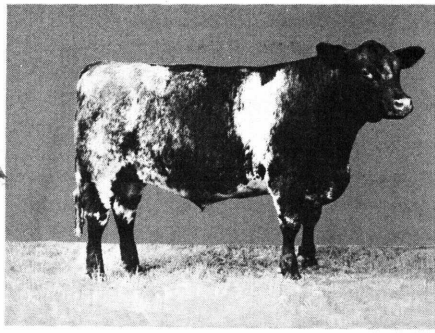

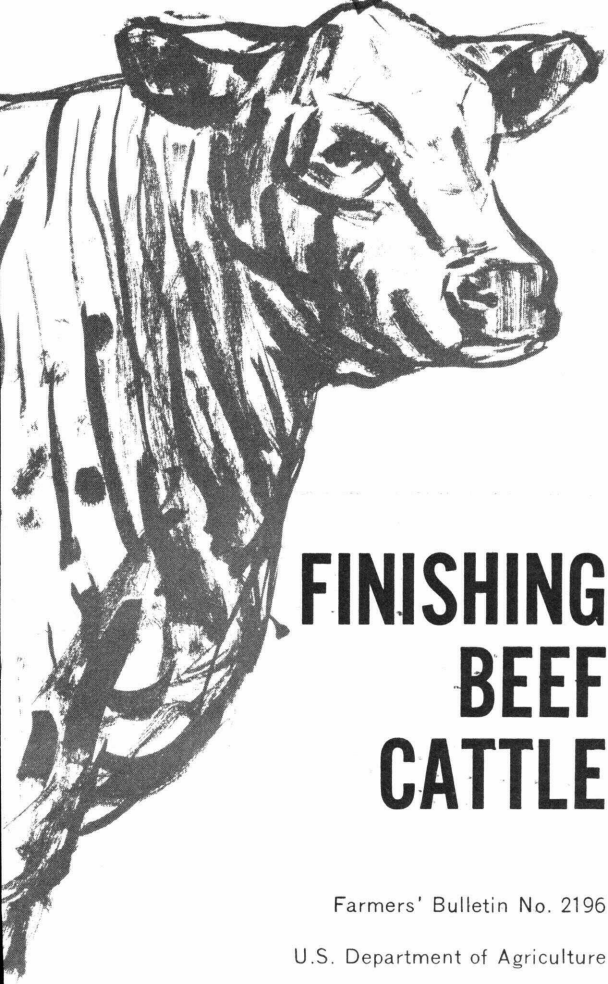

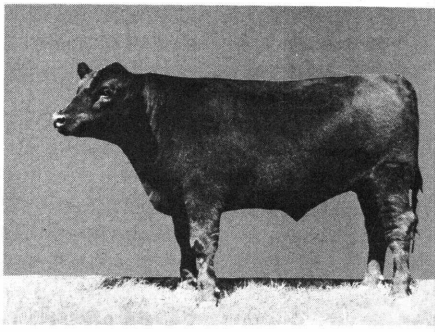

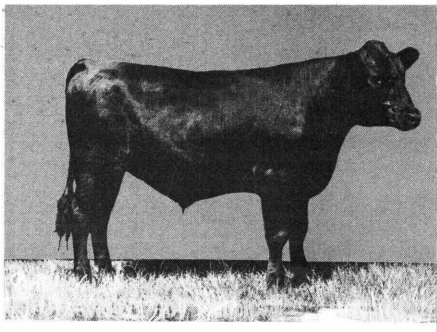

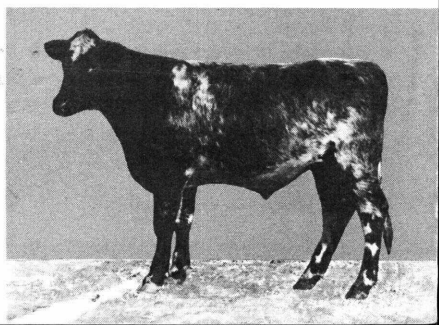

FINISHING BEEF CATTLE

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CONTENTS

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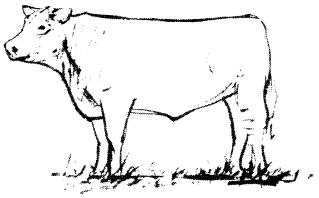
FINISHING



BEEF CATTLE

Prepared by Animal Husbandry Research Division, Agricultural Research Service

Commercial beef cattle producers are broadly divided into two groups—those who purchase feeder cattle and finish them for market and those who have brood-cow herds. Feeding operations require relatively large amounts of concentrates or exceptionally high-quality pastures, while brood-cow herds are best adapted to farms or ranches having large quantities of roughage but little concentrates.

Cowherds are concentrated in the range areas of the Western, Southwestern, and West North Central States. Since World War II the South has also become an important cowherd area. In many localities, particularly in the North Central States and the South, both cowherds and feeding operations are found on the same farms. This is desirable if a farm has considerable acreage suited only to grazing. It is also desirable if a farm produces grain (or is located in an area where grain can be purchased at reasonable prices) and produces large quantities of unmarketable roughage. Finishing cattle on the farm where they are produced eliminates shipping costs, commissions, and risk of disease involved in moving feeder cattle from one area to another. However, there is a trend toward specialization.

Cattle feeders are of two general kinds—(1) commercial operators who feed large numbers, often thousands, of head at a time, and purchase most or all feed, and (2) farmer-feeders who feed cattle largely to market feeds produced on their own farms. There is much overlap between the two kinds. Many farmer-feeders handle enough cattle to necessitate feed purchases.

The objective of every cattle feeder is to make a profit on his cattle or to market available feed at above-market prices by changing feeder cattle into finished steers and heifers in demand for slaughter. The type of feeding operation which can be most successfully carried on depends on types of feeder cattle available; labor, kind and quality of feeds; and market demands for a particular area.

Demand in the United States seems to be concentrating on slaughter cattle weighing 800 to 1,100 pounds and grading Good to Choice. Most cattle feeders should aim to produce animals meeting these specifications unless special situations make other goals more profitable.

CATTLE FEEDING SYSTEMS

Some of the more common feeding systems are discussed below and the approximate kinds and types of feed required for each are given in table 1.

Steer Calves

Immediate Full Feeding in Drylot

Calves are typically purchased in the fall when large runs of feeder calves are marketed, worked up to a full feed of concentrates as rapidly as possible, and fed to weights of 900 to 1,000 pounds. This system is usually best adapted to fleshy high-quality calves and to farms with limited roughage supplies and low-cost grain. Feeding to heavier weights to produce Prime carcasses is possible if market demands warrant and if cattle are of sufficient quality. Sometimes calves are started on concentrate feeds more slowly, wintered largely on roughage or high-quality silage, worked up to full feed in March or April, and marketed in September or October without use of pasture. This is an important trend in modern beef production.

Deferred Full Feeding

Steer calves are purchased in the fall and are wintered on hay, corn silage, or other roughage with limited amounts of grain to produce gains of 1.25 to 1.50 pounds daily. They are grazed on high-quality pasture for 90 to 120 days in the spring and summer either without grain or with a limited feed and then full fed on concentrates for 90 to 120 days, either in drylot or on pasture.

As an alternative, calves may be purchased in the fall, wintered to gain one-half to 1 pound daily entirely on roughage, except for mineral and protein supplements, grazed a full season, and fed out in drylot for 120 to 150 days.

Heifer Calves

Heifer calves purchased in the fall can either be put on immediate full feed or grown for a time on high-roughage rations before being put on full feed. Heifers finish at lighter weights than steers and therefore they should not be kept on roughage too long before the finishing period. They should be marketed at from 750 to about 950 pounds.

Yearling Steers

Immediate Full Feeding

Yearling steers become available over a greater range of time than is the case with calves and they vary considerably in weight at purchase, animals ranging from 550 to 750 pounds often being available. Heavier yearlings are most suitable for full feeding, requiring feeding periods of 120 to 150 days.

Deferred Full Feeding

Yearling steers are often used to glean crop residues such as cornfields, wintered on high-roughage rations, and finished the next summer, either in drylot or on pasture for a late summer or early fall market.

In some cases they are grazed all or most of the season without grain, then fed out for late fall or winter marketing. Lighter yearling feeders are better for deferred feeding systems.

Two-Year-Old or Older Steers

Older steers weighing 800 to 1,000 pounds are usually put on intensive feed for relatively short periods (90 to 100 days). Higher percentages of roughage can be used in their rations than is the case with full-fed calves or yearlings.

KINDS OF CATTLE TO FEED

All kinds of cattle can be profitably fed under conditions suited to their use. The following general guides will be helpful in deciding which kind of cattle best fits your circumstances.

Sex

More steers than heifers are available for feeding since a proportion of heifers must be retained as herd replacements.

If fed for the same length of time, steers gain approximately 10 percent faster than heifers and their gains are usually 10 to 15 percent more efficient. Heifers finish at lighter weights and if marketed at equal degrees of finish will make nearly as rapid and as efficient gains as steers, but they generally are bought and sold for less per pound than are steers. For these reasons they are best suited for shorter feeding periods. Heifers are well suited for those areas where light carcasses are desirable.

Most heifers available for feeding are young and light in weight. Even so, and particularly at heavier weights, feeder heifers may be pregnant when purchased. If noticeably pregnant at slaughter they sell at a discount.

Young bulls gain faster and more efficiently than steers of the same age, and produce leaner carcasses. The carcasses are nearly the same eating quality as those of the steers. Young bulls are not as acceptable on the market, however, and, unless a known outlet is available, feeding steers or heifers is a safer undertaking.

Age and Weight

Feeder cattle available range from 350-pound calves to older feeders weighing 1,000 pounds or more.

Important characteristics of the more common ages and weights are:

Calves

1. Make more efficient gains than older cattle.
2. Make possible maximum flexibility by being adaptable to many different systems of cattle feeding.
3. Require long feeding or grazing periods to reach popular market weights.
4. Use relatively less roughage and more grain than older animals if fed out directly for slaughter.
5. Require high-quality feeds. Thus, calves are not well adapted to gleaning cornfields or making efficient use of low-quality roughage, pasture, or feeds.
6. Are likely to have more sickness and higher death losses.
7. Are light at purchase. Therefore, a high proportion of the weight sold is gain. Efficiency of feeding is more important in feeding calves than it is in feeding older cattle; success depends more on this factor than on skillful buying and selling.

Yearlings

1. Tend to have fewer health problems than younger cattle.
2. Go on feed and finish faster than calves.
3. Make possible flexibility in feeding programs without cattle getting too heavy for market demands before sufficiently well finished.
4. Can use relatively large amounts of roughage, some of which can be low quality (stalk fields, by-products, etc.).

Older Feeders

1. Make rapid but inefficient gains and are least flexible.
2. Use large quantities of roughage in relation to concentrates.
3. Have few health problems.

TABLE 1.—*Amounts of feed required for several cattle feeding systems*

[Amounts are approximate and will differ according to cattle weights, quality of feeds, differences in length of grazing season, etc.]

Data on feeding systems				Average amounts of feed (other than pasture) required by 1 animal in 1 day [1]			Pasture required
Name of system	Weight range of animals fed	Approximate days of feeding	Average daily gain	Harvested roughage (hay equivalent) [2]	Grain	Protein supplement [3]	
	Pounds		*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Days*
Drylot finishing of steer calves	400–450 to 950–1,000	275	2. 0	5	13	1. 25	
Drylot finishing of heifer calves	375–425 to 850–900	230	1. 75	4	12	1. 25	
Deferred feeding of steer calves:							
Winter	400–450 to 1,050–1,100	150	1. 50	8	5	1	
Pasture	do	120	1. 50				120
Drylot	do	100	2. 0	7	15	1	
Drylot finishing of yearling steers	650–700 to 1,050–1,100	175	2. 25	7	14	1	

Drylot finishing of yearling heifers	550–600 to 900–950	130	2. 25	7	13	1	
Deferred finishing of yearling steers:							
Winter	600–650 to 1,100–1,150	150	. 75	14	3	1	
Pasture	do	150	1. 75				120
Drylot	do	80	2. 50	10	16	1	
Drylot finishing of long yearling or 2-year-old steers.	850–950 to 1,100–1,200	100	2. 50	10	16	1	
Wintering of low-quality yearling or older steers, using maximum roughage.	500–800 to 750–1,050	160	1. 50	15	4	1	

[1] To find average per animal for entire feeding period, multiply amounts shown by number of days of feeding (col. 3).

[2] Average silage contains about ⅓ as much dry matter as hay. Therefore, multiply by 3 to put silage on a hay basis. Corn silage contains about 15 percent of grain, and this should be considered in computing rations for cattle. A combination of silage and hay is often fed.

[3] Computation based on supplements containing 41 percent of protein and on assumption that about half of roughage contains from 10 to 15 percent of protein. Reduce amounts by 50 to 75 percent if all roughage is high quality (16 percent of protein or above), and increase by 50 to 100 percent if all roughage is low quality (8 percent of protein or below).

4. Are heavier at purchase. Therefore, a high proportion of their selling price is derived from resale of purchase weight. Profits depend more on skillful buying and selling than on low-cost gains.

Grade

Feeder cattle range from well-bred beef animals to those of nondescript or dairy breeding. Grades are: Prime, Choice, Good, Standard, and Utility. Pertinent facts to consider in deciding on quality or grade to feed are:

1. If all animals are healthy, rate and efficiency of gains of different grades of comparable initial weights are likely to be similar.

2. Ordinarily cattle of a given feeder grade can be profitably finished only to the corresponding slaughter cattle grade or one grade higher; that is, Good feeders should be finished to Good or Choice slaughter grades but not higher, etc.

3. Lower grade feeders are best adapted to high-roughage rations since they are limited by quality in obtaining a high slaughter grade. This is not because they will not gain as rapidly or efficiently as higher grade animals, but because roughage will put as much finish on them as can be justified by slaughter price. These are general guides. At times when grains are low priced in relation to roughages, it may be profitable to feed Standard cattle to low Choice or high Good slaughter grades on high-concentrate rations. This practice has been encouraged by modifications of grading practices that put relatively more emphasis on intramuscular marbling and less on conformation and external fat cover.

4. Purchase price of low-grade feeders must be lower than seems reasonable at first thought. An example will make this clear; see below.

5. Lower grade feeders sell relatively low in the fall and prices of lower grade slaughter cattle are relatively high in the spring. Thus, they are best adapted to short winter feeding periods on rations high in roughage. Beware of cattle that appear to be stunted, parasitized, or diseased.

EXAMPLE (see paragraph numbered 4 under "Grade")

Assume that 500-pound feeders are fed to 1,000 pounds, that costs of gain for both Choice and Standard feeders will be 21 cents per pound, that the finished Choice animals will sell for 24 cents, and that the finished Standard animals will sell for 20 cents. The financial statement for each will then be:

	Choice	*Standard*
Sale value	1,000# @ 24¢=$240.00	1,000# @ 20¢=$200.00
Cost of gain	500# @ 21¢=$105.00	500# @ 21¢=$105.00
Maximum cost of feeder to break even	$135.00	$95.00
Maximum price per pound to break even [1]	.27	.19

[1] Break even = $\frac{\text{maximum initial cost of feeder}}{\text{initial weight of feeder}}$

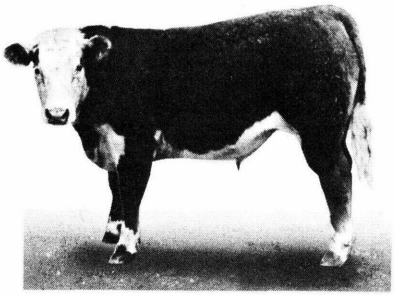
Thus, while the price of the finished Choice animal is only 20 percent higher, a producer could afford to pay 42 percent more for a Choice feeder steer because he will sell his feedlot gains for more per pound.

6. In summary, higher grade feeders are best suited to—

- Finishing to higher market grades.
- Long feeding periods.
- Heavy concentrate rations at least in terminal portion of feeding period.
- Selling in late summer or fall.

Lower grade feeders are best suited to—

- Selling at low degrees of finish.
- Shorter feeding periods.
- Greater use of roughages.
- Selling in spring or early summer.



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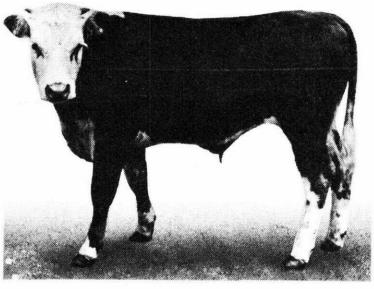

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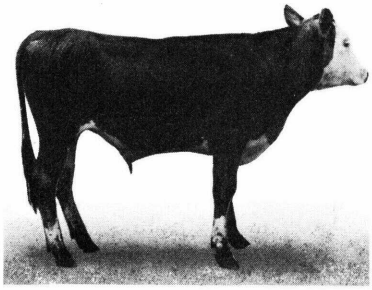

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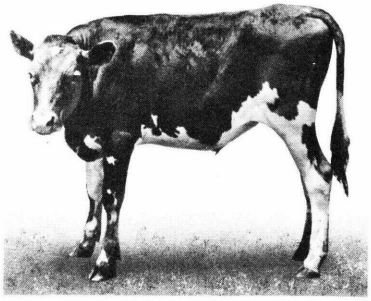

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***Figure 1.*—Feeder steers—U.S. grades.**

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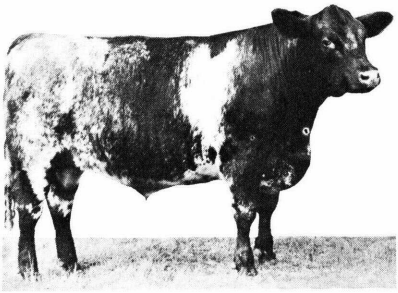

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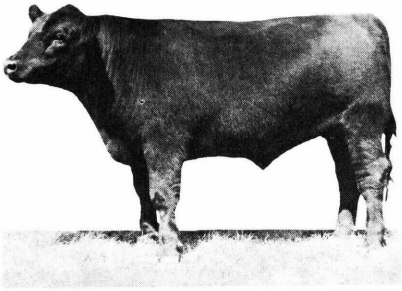

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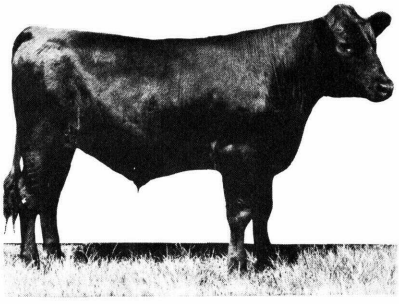

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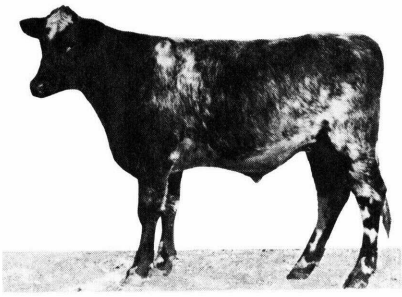

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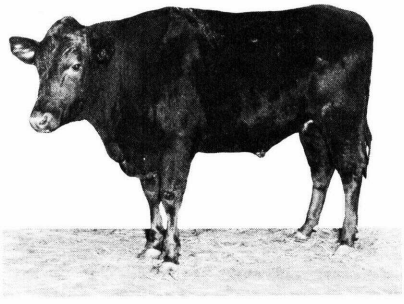

UTILITY

Figure 2.—Slaughter steers—U.S. grades.

WHEN TO BUY FEEDER CATTLE

Feeder cattle are available for purchase in largest numbers in the fall, at the end of the grazing season, with peak movements in October. This is especially true of calves. There is, however, an increasing tendency for feeders to keep their lots full on a year-round basis. As a result, there has been an increase in the proportion of feeders, particularly older animals, being purchased at other seasons. Feeder cattle producers are adjusting their production practices to meet year-round demands.

Figures 3 and 4 show average seasonal trends in prices of both feeder and slaughter steers. All feeders tend to be cheapest in the fall and highest in the spring. Seasonal trends in prices of different grades of slaughter cattle vary greatly from year to year. Average trends for the years 1957–61 are shown in figure 4.

To the extent that his feed supplies and equipment permit, a producer should gear his purchases of feeders and sales of finished cattle to take advantage of these seasonal price fluctuations. But it is important to realize that they are average trends and will not necessarily occur every year.

Many feeders attempt to outguess the market both in buying and in selling cattle. This is often not successful. *Cattle feeders would be better advised to adopt a feeding program best adapted to their own feed supply and follow it consistently.*

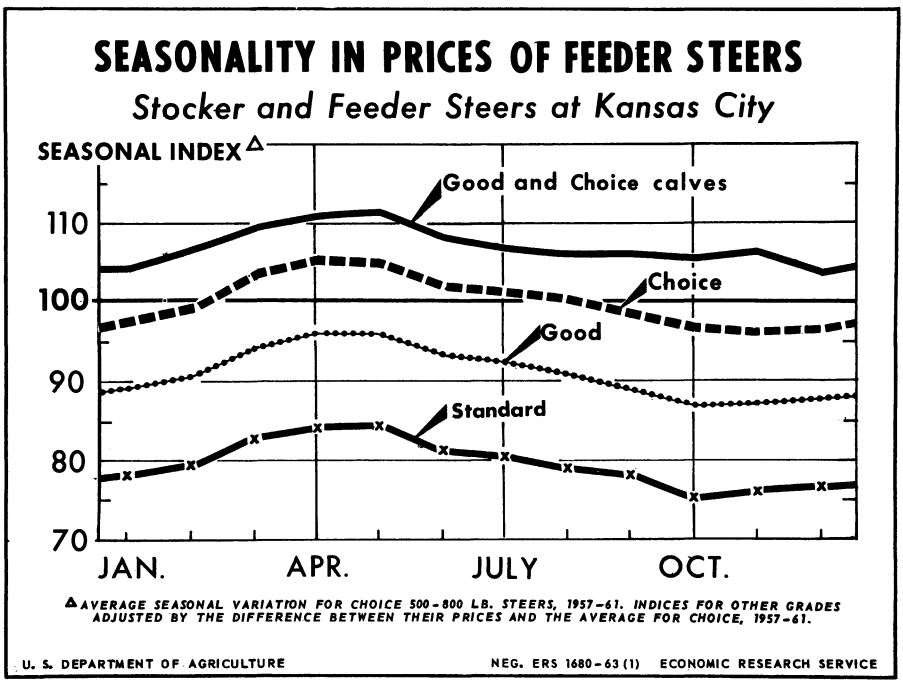

Figure 3.—**Seasonality in prices of feeder steers.**

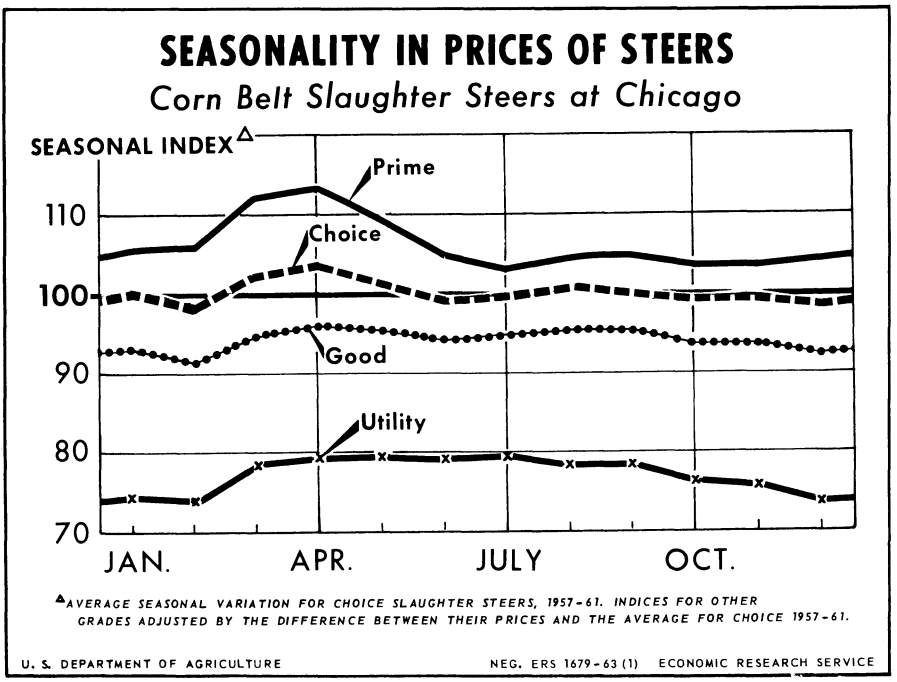

***Figure 4.*—Seasonality in prices of slaughter steers.**

ROUGHAGES AND PASTURE

General Aspects

Cattle put their feed to three uses—(1) maintaining body functions, (2) growth, and (3) fattening. In young animals these three functions have priority on nutrients in the order given. All animals need feed for maintenance. If nutrients over maintenance requirements are available, growth occurs, and if additional nutrients are available, fattening proceeds. As animals get older and approach maturity, growth slows and an increasing proportion of the feed goes to produce fat. Older cattle, therefore, finish in shorter periods of time than younger ones.

Roughages alone, or supplemented by protein concentrate if they are not legumes, will provide for maintenance and growth of young cattle but for very little fattening. Concentrates in addition to roughages are necessary to finish cattle to an acceptable market finish at less than 2 years of age.

It is not known with certainty how much roughage fattening cattle need for optimum performance. Formerly it was considered that at least 10 to 20 percent dry roughage equivalent was necessary for normal growth and fattening. Later studies show that all-concentrate rations properly supplemented with minerals and vitamins produce satisfactory performance. Barley, which has a fairly high fiber content, or corn-and-cob meal has been most frequently used in these rations. Such rations have several potential hazards and cattle feeders should be careful in starting cattle on feed. A feeder can get good re-

sults by starting with a 50-percent roughage ration and making stepwise reductions over a 3-week period or by following recommendations made by his State experiment station on the basis of experiments with the specific feeds being used.

Within wide limits, the feeder has a great deal of flexiblity in determining roughage : concentrate ratios in rations of finishing cattle. Maximum gains and fattening are usually obtained on high concentrate to roughage ratios (2:1 or 3:1) but rations as low as 1:1 give almost as rapid gains and are quite satisfactory, particularly early in the feeding period for calves and for cattle not being fed for extremely high grades. If grain is to be limited, a highly palatable roughage, such as silage, green-chop, or high-quality hay, must be fed to get a high dry-matter intake.

As a general guide, most grains contain 75 to 80 percent of TDN (total digestible nutrients), while most medium to good quality hays have 45 to 50 percent. Hay at five-eighths or less the price per ton of grain is an economical feed. If the price is more than this, relatively high proportions of grain will give cheaper gains. Legume hays have values somewhat higher than indicated because of their protein content. More exact evaluation of feedstuffs can be made by using net energy values instead of TDN because the latter overevaluate hays and underevaluate grains.

Hay

Hays of various kinds are the most widely used roughages in cattle finishing rations and are the standards with which other roughages are compared.

Well-cured hay with a green color is a good source of carotene, the precursor of vitamin A. Legume hays are usually high in protein and calcium.

High-quality hays are superior from the standpoint of cattle performance—and, when they are fed, supplemental feed requirements are lower. However, lower quality hays give very satisfactory results if properly supplemented.

Silage

Corn silage is an excellent feed for fattening beef cattle. Nutrient production per acre is greater from silage than from corn harvested by any other method.

Because of its grain content, corn silage has a higher TDN value than most other roughages on an equivalent moisture basis.

Sorghum silages vary in value, the value depending largely on the percent of grain in the variety ensiled, but are usually from 60 to 90 percent as valuable as corn silage in finishing rations.

Both corn and sorghum silages are low in protein and must be supplemented adequately for good results.

Hay-crop silages, commonly called "grass silage" even if legumes or grass-legume mixtures are ensiled, are often less palatable and have generally not given as good results as corn or good sorghum silage. They are, however, satisfactory feeds, particularly for cattle on full grain feed. Low-moisture grass silage (often called "haylage") is more palatable and gives better results than conventional grass silage of usual moisture content.

Good-quality silage for fattening steers can be produced from small grain harvested just beyond the boot stage, from millet, and from other grasses if ensiled with 100 to 200 pounds of carbohydrates (corn, molasses, or citrus pulp) per ton of green weight. If they are cut well before maturity, these plants are relatively high in protein and are palatable; the carbohydrate adds to

the quality, odor, and nutrient value.

Silages usually have only one-fourth to one-third the dry-matter content of hay and must be fed in correspondingly larger amounts to supply equivalent amounts of nutrients. There is a trend toward drier silages, moisture levels of 60 to 65 percent being common, even when stored in conventional silos. Silages are excellent for starting cattle on feed, especially the first 60 to 90 days, for low-cost gain. If full fed with limited grain, cattle will eat about 7 pounds per hundredweight.

Other Roughages

Lower quality byproduct roughages—cottonseed hulls, corncobs, oat hulls, beet tops, peanut hay, cereal straws, and many others—often can be used in finishing rations if properly supplemented. When these products are available at what appear to be reasonable prices, feeders are advised to consult their county agricultural agent or the State agricultural experiment station about feeding values. As a general rule, products such as these should not be substituted for more than half the roughage (dry-matter basis). But it is possible to obtain good performance by feeding these roughages and no others, provided they are properly supplemented with additional protein, vitamins, and minerals. Relative costs of the byproducts, better quality roughages, and the necessary supplements are the determining factors in deciding whether the byproducts should be used at all. It is usually better to feed these roughages to stocker cattle.

Pasture

Years ago large numbers of cattle were finished entirely on pasture. Certain areas such as the Flint Hills of Kansas and the bluegrass regions of Kentucky, Virginia, and West Virginia have high-quality pastures for steer fattening.

Few cattle are now finished in this manner, because of the falling demand for heavy, grass-fat slaughter steers weighing 1,200 pounds or more. Young cattle grow but do not fatten under usual pasture conditions, and it is only at ages of 2 to 3 years, after growth has been largely attained, that finishing occurs on pasture. Thus, it is impossible to finish calves or yearlings entirely on pasture without having them above the preferred weight. Because of the demand for cattle weighing less than 1,200 pounds, it is best to use pasture as a supplement to concentrate feeding rather than as the sole ration.

Points to consider regarding use of summer pastures in most areas of the United States for finishing cattle are as follows:

1. Calves or yearlings purchased in mid to late summer will gain when grazed on good permanent pasture or meadow aftermath till frost. Cheap gains during this period result in a reduction in cost per pound when they go on feed as compared to putting them in the feedlot immediately.

2. Yearling feeder cattle make gains of 1¼ to 1½ pounds daily when grazed on good pasture all summer without supplemental feeding. Pasture gains will be greatest if winter feeding levels have been low to moderate. Under average conditions, a feeding period of 90 to 120 days on high-concentrate rations will be required after the grazing period to put cattle in Good to Choice grades. In most cases feeding should start at not more than 750 to 800 pounds in order that weight when finished will not be above slaughter weights in greatest demand.

3. Cattle of any age can be fed concentrate rations on pasture.

4. Annual summer pastures of millet or sudangrass are usually more palatable and digestible than the permanent pasture grasses and can be used very successfully with or without grain supplement during the first part of the fattening period.

To summarize, pasture gains are usually cheaper than drylot gains since the cattle harvest their own feed from the pasture and the protein in good pasture forage reduces the requirement for supplemental protein feeds. Also, less grain is consumed with equal gains; hence gains require less concentrates. Gains will not be cheaper, however, on poor-quality or dried-up pastures.

Average daily gains and degree of finish attained are likely to be slightly less on pasture. Even if of similar finish, pasture-fed cattle are likely to sell for slightly less. Pasture feeding usually results in fat with a slight to pronounced yellow color, and cattle that show evidence of pasture feeding are frequently discounted on the market.

Pasture feeding may save labor. Manure spreading will be eliminated.

A special way of finishing cattle on pasture is the use of annual crops such as winter oats, rye, rye-grass, and crimson clover for winter and early spring grazing in the South. Wheat is used heavily in the Southwest. When seeded in the fall in areas adapted to them, these crops will usually provide grazing for a period starting in November to February and lasting until April or May. The time at which these crops will be ready for grazing in any area varies from year to year; so they are less dependable than most other feed sources because of climatic conditions in many areas. Their nutritional value is high, and cattle make gains on them practically as high as can be obtained on high-concentrate rations in drylot.

These pastures can usually be used to best advantage in one of the following ways:

1. As the principal finishing feed for long yearling steers. These animals can usually be marketed for slaughter directly off winter pasture after grazing for 100 to 120 days if they start as fleshy feeders.

2. As the principal feed for the first half or two-thirds of the finishing period for younger or less fleshy yearling steers. A short period of drylot feeding will usually be needed to reach the most desired market finish.

3. As the principal feed for calves during the early part of the finishing period. Calves may need supplemental feed more often than older steers while on winter pasture if forage quality is below normal, and will usually require a drylot finishing period of 90 to 120 days after the pasture season.

In areas where winter annual pastures can be grown, feeders should follow recommendation of State experiment stations. Success with them depends upon systems adapted to local situations.

FEEDING PROCEDURES AND GETTING CATTLE ON FEED

Concentrates and roughages are often fed separately on farms, although concentrates are frequently spread on top of silage and the cattle do a considerable amount of mixing. Ordinarily, at least one component of the ration should be fed to the limit of appetite. Early in the feeding period, this should be roughage (either hay or silage), while later on it usually should be concentrates. Cattle on full feed

of concentrates will usually voluntarily limit their roughage consumption to about three-fourths pound per 100 pounds of live weight, but occasionally it is necessary to cut down on amounts in order to get desired concentrate consumption if very palatable roughage is fed.

After cattle are on full feed, they can either be self-fed or hand-fed. Self-feeding, either with self-feeders or with bunks in which feed is constantly before cattle, usually increases gains and often reduces labor; also, there is less danger of cattle going off feed. Feed required per pound of gain may be slightly higher than with careful hand feeding. Hand-fed cattle are usually fed once or twice daily. Some experiments indicate more frequent feeding (6 to 10 times daily) will produce faster gains. It is doubtful whether the increased gain will be enough to pay for the higher labor cost. However, some mechanized auger systems can operate at whatever interval is chosen without more labor.

Getting cattle on fattening feeds is an art and no definite rules applicable to all conditions can be given. If concentrates and roughages are fed separately, roughage can be self-fed and concentrates increased gradually. The objective is to work up to desired levels rapidly, but if this is done too rapidly the microorganisms that inhabit the rumen will not have sufficient time to adjust to the new ration, and the cattle will go "off feed." The judgment of an experienced feeder is better than rules, since different droves of cattle do not react the same. Table 2 can be used as a general guide.

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***Figure 5.*—A farm feedlot with self-unloading wagon in use.**

TABLE 2.—*Suggested method of increasing feeds in the ration for fattening steers of various weights*

Ration and weight of steers	Pounds of feed daily per head for first day and at beginning of stated periods										
	First day	Second week	Third week	Fourth week	Second month [1]	Third month	Fourth month	Fifth month	Sixth month	Seventh month	Eighth month
Corn and high-quality hay rations											
400-pound steers:											
Grain	1 to 3	5	7	8	10	12	15	16	16	15	----
Hay	5	6	6	6	6	6	6	6	6	5	----
600-pound steers:											
Grain	1 to 4	6	8	10	14	16	20	20	18	----	----
Hay	6	8	8	7	7	7	7	7	6	----	----
800-pound steers:											
Grain	1 to 5	7	10	13	18	20	22	20	----	----	----
Hay	8	10	10	10	10	9	8	8	----	----	----
1,000-pound steers:											
Grain	1 to 6	8	12	16	20	24	24	----	----	----	----
Hay	10	12	12	10	10	10	8	----	----	----	----
Silage rations											
400-pound steers:											
Grain	1 to 3	4	5	6	8	9	10	11	12	13	14
Protein meal	¼	½	¾	1	1¼	1¼	1½	2	2	2½	2½
Hay	3	3	2	2	2	2	2	2	2	2	2
Silage	9	12	15	15	12	9	7	7	6	6	5
600-pound steers:											
Grain	1 to 3	4	6	8	10	12	14	15	16	16	----
Protein meal	½	¾	1	1¼	1¼	1½	2	2½	3	2¾	----
Hay	5	5	4	4	3	3	3	2	2	2	----
Silage	8	15	18	21	21	21	21	18	15	12	----
800-pound steers:											
Grain	1 to 4	6	8	10	12	16	16	16	16	----	----
Protein meal	½	1	1¼	1½	1¾	2	2½	3	3	----	----
Hay	6	6	6	5	5	4	4	3	3	----	----
Silage	15	18	27	27	27	25	20	18	15	----	----

[1] If desirable, cattle can usually be self-fed hay or silage and a grain mixture after the second month.

Commercial feedlots usually grind or chop hay or other dry roughage, mix the concentrates with it, and feed complete mixed rations. Cattle can be started on 60- to 70- percent roughage rations. Concentrate percentages are increased over a relatively short period of time with little danger. When full fed, cattle should eat 2 pounds or more of grain per 100 pounds of body weight. This system simplifies problems of getting cattle on feed.

FINISHING FEEDS

Finishing rations usually contain a high percentage of grains. Shelled corn is widely used and it is generally the standard by which other grains are evaluated.

Corn-and-cob meal makes a bulkier, less concentrated feed, supplies part of the roughage in the ration, and reduces the tendency to go off feed. Corn-and-cob meal is excellent early in the fattening period and often no additional roughage is needed.

Cost of grinding and possibilities of waste from blowing are factors to consider in deciding whether or not to feed corn-and-cob meal. In some areas of the South where insect damage of stored ear corn is a problem, corn is "snapped" with the husks left on the ear. Ground snapped corn is an excellent finishing feed. It supplies more roughage than corn-and-cob meal.

Rolled barley is an excellent feed for finishing cattle, averaging about 88 percent the value of corn. When fed in "all-concentrate" rations it may approach the value of corn. Quality of barley varies considerably, depending upon the area and season in which the crop is grown. There is sometimes a tendency for cattle to bloat when fed barley as the only grain, especially if alfalfa hay is being fed.

Ground or rolled grain sorghums are satisfactory finishing feeds but do vary rather widely in feeding value. Different experiments have shown values ranging from approximately 80 to 95 percent as much as corn.

Oats are good for young growing cattle and a feed of about half ground oats and half cracked corn is often helpful in getting cattle on full feed. After this is accomplished, the oats can be gradually withdrawn from the mixture. Oats

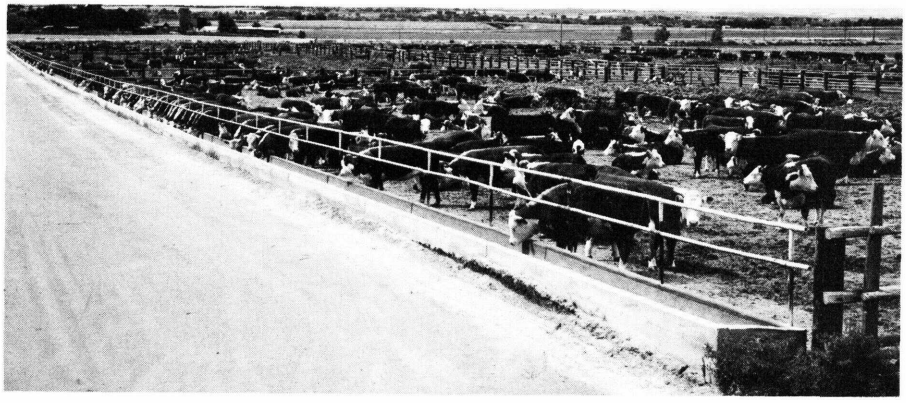

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***Figure 6.*—A commercial-type feedlot. The troughs are built along the side of the fence nearest the road so that trucks can feed the cattle as they drive by.**

are usually not an economical finishing feed unless the price per bushel is one-half or less that of corn.

Dried beet pulp or dried molasses-beet pulp has more fiber than grains but is worth as much per ton as barley or grain sorghum when substituted for up to one-third to one-half the grain in finishing rations. They tend to reduce digestive disturbances and bloat.

Cane, beet, and citrus molasses are worth 60 to 70 percent as much as shelled corn if substituted for up to half the grain in finishing rations. Molasses tends to improve palatability and reduces dustiness when mixed 3 to 8 percent with many ground feeds or complete rations. In some experiments, feeding small amounts of molasses (2 to 4 pounds daily) has stimulated feed consumption and gains when low-quality roughages are used. Since molasses is low in digestible protein a higher level of protein supplementation is required.

Many commercial mixed feeds contain molasses, often being known as "molasses feeds." If well formulated, these feeds are excellent for cattle, but in most experiments their cost has been too high to produce as economical gains as standard rations. Some such feeds are prepared by mixing molasses with low-grade or highly fibrous feeds or byproducts. Such feeds are of low feeding value.

A large number of other carbonaceous byproduct feeds, such as cottonseed hulls, citrus, and cannery and vegetable wastes, are available in many locations and often make excellent cattle feeds. If available, their value should be investigated.

CATTLE SUPPLEMENTS

In most cases grains and forages do not supply all the nutrients necessary in balanced rations for finishing beef cattle. Supplemental nutrients needed may be obtained either by individually purchasing the kinds of supplements needed and mixing them if more than one is required, or by purchasing commercial supplements. These usually supply protein, vitamins, and minerals in various combinations with or without additives. Cost and convenience should determine which method of supplying supplements is preferable in individual situations.

Supplemental nutrients most often needed are discussed in the sections that follow.

Protein

The amount of protein supplement needed depends upon the age of the cattle, the kind and amounts of roughage, and the protein content of the grain or other carbonaceous concentrate being fed.

Generally, finishing cattle being fed rations with no legume hay require about 2 pounds of high-protein supplement per head daily, while those receiving half their roughage as legume hay need only 1 pound. It is questionable whether cattle getting all their roughage in the form of high-quality legume hay need additional protein supplementation in the early stages of fattening when relatively high roughage levels are fed. However, small amounts of supplement are often fed, especially to calves, as "insurance" and to maintain appetite. Supplements are usually needed as roughage intake is reduced in later stages of fattening. Increased amounts of supplement are needed if molasses or low-quality roughages are used.

Quality of protein is not a critical factor in most beef cattle finishing rations, and feeders should usually buy supplements on the basis of

TABLE 3.—*Cost of a pound of protein when the percentage of protein in the feed and the price per ton are known*

Price of feed per ton (dollars)	Cost of 1 pound of protein when percentage of protein is—							
	15	20	25	30	35	40	45	50
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
30.00	10. 00	7. 50	6. 00	5. 00	4. 29	3. 76	3. 33	3. 00
35.00	11. 67	8. 75	7. 00	5. 83	5. 00	4. 38	3. 89	3. 50
40.00	13. 33	10. 00	8. 00	6. 66	5. 72	5. 00	4. 44	4. 00
45.00	15. 00	11. 25	9. 00	7. 50	6. 43	5. 62	5. 00	4. 50
50.00	16. 67	12. 50	10. 00	8. 33	7. 14	6. 25	5. 56	5. 00
55.00	18. 33	13. 75	11. 00	9. 16	7. 86	6. 88	6. 11	5. 50
60.00	20. 00	15. 00	12. 00	10. 00	8. 57	7. 50	6. 67	6. 00
65.00	21. 67	16. 25	13. 00	10. 83	9. 29	8. 13	7. 23	6. 50
70.00	23. 33	17. 50	14. 00	11. 67	10. 00	8. 75	7. 78	7. 00
75.00	25. 00	18. 75	15. 00	12. 50	10. 72	9. 38	8. 34	7. 50
80.00	26. 67	20. 00	16. 00	13. 34	11. 43	10. 00	8. 90	8. 00
85.00	28. 33	21. 25	17. 00	14. 16	12. 15	10. 63	9. 45	8. 50
90.00	30. 00	22. 50	18. 00	15. 00	12. 86	11. 25	10. 00	9. 00
95.00	31. 67	23. 75	19. 00	15. 84	13. 57	11. 88	10. 56	9. 50
100.00	33. 33	25. 00	20. 00	16. 67	14. 29	12. 50	11. 12	10. 00
105.00	35. 00	26. 25	21. 00	17. 51	15. 00	13. 13	11. 67	10. 50
110.00	36. 67	27. 50	22. 00	18. 34	15. 72	13. 75	12. 23	11. 00

price per pound of protein content—buying those which are cheapest. Table 3 is a convenient guide for estimating this.

Cottonseed, soybean, and linseed meals are the most commonly used and readily available protein supplements. When fed with conventional rations there is no appreciable difference between these meals and complex supplements. Complex supplements or mixtures containing dehaydrated alfalfa, molasses, and trace minerals have sometimes improved performance when fed with roughages of very low quality, such as corncobs or cottonseed hulls. Thus, a decision on whether to use a complex supplement should be made after considering the quality of the roughage with which it would be fed and after comparing the cost per pound of protein with the cost of standard supplements.

Cattle can synthesize protein from nonprotein sources. For this reason urea can be used to replace up to one-third of the crude protein in the ration. One pound of urea plus 6 pounds of corn (or its equivalent) is equal to 7 pounds of a 44-percent oilmeal when so substituted in properly balanced finishing rations. Because urea contains no nutrients other than nitrogen, extra grain or readily available carbohydrates or both must be added to make up for the energy in the meal. Urea must be *thoroughly mixed* into the feed. Because of its high protein equivalent, urea can be used to make high protein-equivalent supplements. Feeding-grade urea contains 42 percent of nitrogen, giving a crude protein equivalent of 262 percent.

Some complex supplements are:

Purdue Supplement A (Revised)

	Pounds
Soybean meal	650. 5
Cane molasses	140. 0
Dehydrated alfalfa meal	140. 0
Bone meal	52. 0
Cobaltized salt	17. 0
Vitamin A and D concentrate	0. 5
	1, 000. 0

Oklahoma Supplement [1]

	Pounds
Soybean meal	650
Dehydrated alfalfa meal	250
Molasses	100
Calcium carbonate	25
	1,025

[1] In addition to items listed, includes 2 grams of trace minerals and 21,000 U.S.P. units of dry stabilized vitamin A per head daily.

Iowa Supplement

	Pounds
Soybean meal	415
Cane molasses	225
Dehydrated alfalfa	225
Urea	50
Dicalcium phosphate	30
Stilbestrol premix	5
Dried torula yeast	50
	1,000

Minerals

Salt supplies the essential elements sodium and chlorine and should be available to cattle at all times. In iodine-deficient areas of the country, stabilized iodized salt should be fed. The amount of salt consumed will vary with the age of cattle and type of feed but will usually average ½ to 1½ ounces per head daily. Loose granulated salt, salt blocks, or crushed screened rock salt are all suitable for cattle. Cattle usually prefer the softer types of blocks and will consume more loose than block salt. Loose salt should be protected from the weather.

Calcium and phosphorus are also essential elements, and with some types of rations supplements are necessary. Legumes usually supply adequate calcium if they are fed as the principal roughage. Phosphorus deficiencies occur in several areas among beef cattle on pasture, but protein supplements and grains usually supply adequate amounts for finishing feedlot cattle.

If nonlegume roughages are fed, a mixture of equal parts salt and finely ground limestone, oystershell, or calcium carbonate should be fed. The mixture should be separate from the main salt supply so that animals will not have to eat a calcium supplement to get salt they want. If there is a possibility of phosphorus also being deficient, a mineral mixture of equal parts of salt, and of steamed bonemeal, dicalcium phosphate, or defluorinated phosphate, should be provided.

In some areas of the country, as shown in general on the map in figure 7, certain trace minerals are deficient. Consult your county agent or write to your State experiment station to determine whether your area is one in which supplements are needed. Trace minerals may be needed if poor-quality roughage or "all-concentrate" rations are fed.

Vitamins

Since cattle synthesize the B-complex vitamins in the rumen, there is no need to add them to the ration of healthy cattle. No vitamin C deficiency has been found in cattle. Normal feedstuffs contain adequate vitamin E. Cattle require vitamin D but synthesize adequate amounts when exposed to sunlight as is normally the case with finishing cattle.

Cattle store vitamin A in their livers when surplus amounts of carotene or vitamin A are consumed. Deficiencies usually occur only after prolonged periods on mature, dry, bleached forage. Green forage (including pasture), leafy green hay (except hay stored for several years), and silages contain carotene, which the animal converts to vitamin A. If cattle are on rations that do not include green forage, sufficient carotene can be supplied by feeding a supplement of one-half to 1 pound daily of dehydrated alfalfa meal. Or, vitamin A can be supplied in the synthetic form or in vitamin A and D oil.

A problem not yet fully understood has to do with apparent high vitamin A requirements in cattle fed

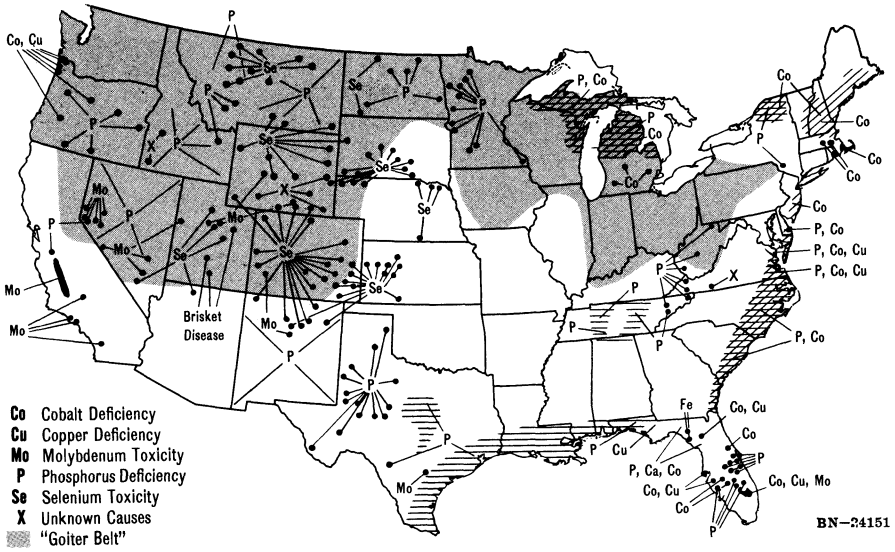

***Figure 7.*—Known areas in the United States where mineral-nutritional diseases of animals occur. The dots indicate approximate locations where troubles occur. The lines not terminating in dots indicate a generalized area or areas where specific locations have not been reported.**

corn silage or grazed on annual pastures which were grown on soils heavily fertilized with nitrogen. Some research workers have speculated that nitrates might be a causative factor in altering vitamin A metabolism. Feeding 20,000 to 30,000 U.S.P. units of synthetic vitamin A daily prevents development of deficiency symptoms, and feeding 100,000 U.S.P. units daily permits recovery of cattle which are showing symptoms.

Cattle fed all-concentrate or very high-concentrate rations apparently have higher vitamin A requirements than had hitherto been expected. This problem, too, is not completely understood. Feeding at least 20,000 U.S.P. units of vitamin A daily with such rations appears to be necessary for optimum performance under at least certain conditions. There are some indications that higher vitamin A levels are beneficial in hot weather.

Feeders should watch for the following symptoms of vitamin A deficiency:

- Rough and dusty hair coat.
- Watering eyes and salivation.
- Loose and watery droppings.
- Edema.
- Night blindness.

Feeders should keep informed about experiment station work on these two problems and follow revised recommendations as they appear in experiment station reports.

FEED ADDITIVES AND HORMONAL IMPLANTS

Feeding 10 milligrams daily of diethylstilbestrol (popularly known as stilbestrol), a synthetic chemical that has female hormone properties, has been shown to improve rate of gain 10 to 15 percent and efficiency

of gain by about 10 percent in feedlot cattle on finishing rations. Carcass grades and dressing percentages are not affected if supplemented and unsupplemented cattle are fed the same length of time. No carcass residues have been detected if feeding is at recommended levels and if the chemical is withdrawn from feed, as required, 48 hours before slaughter. Responses from feeding stilbestrol to cattle on growing rations or on pasture have been less consistent and smaller on the average. Stilbestrol is sold only to feed manufacturers in premixes.

Stilbestrol is usually sold in protein supplements which contain from 24 to 32 percent of crude protein. These supplements contain 0.0011 percent of stilbestrol and are fed at the rate of 2 pounds per head daily. By using urea the crude protein equivalent can be increased to 50 percent. These mixtures usually contain 0.0022 percent of stilbestrol and are fed at the rate of 1 pound per head daily. These feeding rates will supply 10 milligrams of stilbestrol per head daily. *Be sure to read the instructions on the label and follow them exactly.*

Implants of 12 to 36 milligrams of stilbestrol or combination pellets of two other female sex hormones, progesterone and estradiol, have shown growth-stimulating properties in both pastured and feedlot cattle. Side effects are less likely if implants are held to 24 milligrams or lower, rather than 36 milligrams. One implantation lasts about 150 days. Heifers are less responsive than steers, and the dosage should be reduced in half for them. Yearling cattle implanted on pasture prior to going to a feedlot usually show less response if reimplanted or fed stilbestrol. Implants of estradiol-progesterone for steers and testosterone (a male sex hormone) and estradiol for feeder heifers have given about the same response as 24 to 36 milligrams of stilbestrol.

Low-level antibiotic feeding has given variable results in experiments. These materials may be fed when indicated. They are often fed to freshly shipped cattle to prevent shipping-fever complex.

Many other additives, including tranquilizers, enzymes, surfactants, chemobiotics, and yeast, have been tried in research by experiment stations but have given inconsistent or inconclusive results.

All additives, hormone treatments, and related products and treatments are subject to approval by the Federal Food and Drug Administration. As new information becomes available, new approvals may be made, required procedures for use modified, or approval withdrawn for use of previously approved products. Feeders should, therefore, carefully follow new information released on these matters.

PREPARING FEEDS

Shelled corn is a satisfactory feed for beef cattle but part of it goes through undigested. To get full value from shelled corn, cattle should be followed with hogs. Pigs weighing 50 to 150 pounds are best and should be included in feedlots at the rate of one pig to every one or two 2-year-old steers, every two yearlings, and every three calves. Pigs following steers fed shelled corn should gain about three-fourths pound for each bushel of corn fed to calves, about 1 pound for each bushel fed to yearlings, and about 1½ pounds for each bushel fed to 2-year-olds. If corn is ground or if corn-and-cob meal is fed, undigested feed available for hogs will be greatly reduced and only one-third to one-half as many should be put in the lots. Many cat-

tle feeders let pregnant sows follow cattle. This is a good practice because pregnant sows should be limited fed, and in following cattle they can obtain a large vitamin intake plus exercise. The danger of injury to the sows is not great.

With the increased use of picker-shellers, high-moisture corn is produced. If stored in airtight silos, it makes excellent cattle finishing feed and during the latter part of the finishing period it may be equal to or better than low-moisture corn on a dry-matter basis.

Other grains in cattle rations should be coarsely ground or rolled—the two methods are about equally satisfactory. Steam rolling of milo, corn, and barley is also satisfactory but is more costly than other methods of preparation.

Chopping or coarse grinding of hay usually reduces waste, increases consumption somewhat, and may increase gains slightly. Whether or not it will pay in individual cases depends upon the relationships among cost of chopping or grinding, price of hay, and convenience of storing and feeding as compared to long hay. Lower quality roughages usually benefit most from chopping or coarse grinding. It is usually advisable with corn or sorghum fodder or stover. Roughage should not be finely ground. Roughage grinding is necessary in mixed, self-fed rations.

No specific answer can be given to the question of whether feeding complete, ground, mixed rations is better than feeding roughage and concentrates separately. Most experiments have shown no improvement in cattle performance with mixed rations. (An exception to this has been noted in cases where the roughage was low in palatability and concentrates were limited to force the consumption of a predetermined percentage of roughage.) On the other hand, feeding complete, ground, mixed rations is often more convenient and, as pointed out previously, such rations are an aid in getting cattle on feed. Thus, it would appear that each cattle feeder must make his own decision on the basis of the relation of convenience to the cost of grinding and mixing.

Pelleting high-roughage or all-roughage rations increases consumption and gains up to 25 percent. Low-quality roughages are improved most by pelleting. However, costs of pelleting are usually so high that each individual must decide, on the basis of available facilities and type of ration, whether pelleting would be economical; no general recommendations can be given.

Pelleting high-concentrate rations decreases feed intake and reduces gains slightly, but in most experiments it has increased feed efficiency by 5 to 10 percent. It is doubtful if pelleting will often pay with high-grain, finishing-type rations.

Cooking, soaking, fermenting, and similar types of feed preparation are not recommended for beef cattle.

EXAMPLES OF ADEQUATE RATIONS

When feeding complete mixed rations care must be taken to insure that they contain adequate protein, energy, minerals, and vitamins. Salt can be provided separately free choice or at a level of one-half to 1 percent in the ration. During long feeding periods the composition of the ration should be altered to correspond to weight increases of the cattle.

The rations given in table 4 are designed to meet the nutrient requirements of beef animals of the ages specified. *They are to be used as general guides only.* Quality of

feeds available and relative prices will make it desirable to deviate rather widely from these guides in specific cases. General rules enumerated on pages 24 and 25 may be followed for substitutions.

TABLE 4.—*Examples of beef cattle rations when cattle are on a full feed* [1]

STEER CALVES—INITIAL WEIGHT 400 TO 450 POUNDS

Dry rations		Rations with silage	
	Pounds per day		*Pounds per day*
Grain	11 to 14.	Grain	10 to 14.
High quality legume hay	5 to 6.	Protein supplement	0.5 to 1.5.
		High quality legume hay	2 to 4.
Grain	11 to 14.	Corn or sorghum silage	8 to 12.
Protein supplement	1.25 to 1.75.		
Mixed hay or low quality legume hay	4 to 6.	Grain	10 to 14.
		Protein supplement	1 to 1.5.
Grain	11 to 14.	Mixed hay or low quality legume hay	2 to 4.
Protein supplement	1.5 to 2.0.	Corn or sorghum silage	8 to 12.
Grass hay	4 to 6.		
		Grain	10 to 14.
Barley	7 to 9.	Protein supplement	1.50 to 2.00.
Dried molasses beet pulp	4 to 6.	Grass hay	2 to 4.
High quality legume hay	4 to 6.	Corn or sorghum silage	8 to 12.
Milo	12 to 14.		
Soybean meal	1.5 to 2.0.		
Cottonseed hulls	3 to 5.		

STEERS—INITIAL WEIGHT 600 TO 750 POUNDS

Grain	13 to 16.	Grain	12 to 15.
High quality legume hay	6 to 8.	Protein supplement	0.75 to 1.25.
		High quality legume hay	3 to 5.
Grain	13 to 16.	Corn or sorghum silage	14 to 18.
Protein supplement	1.25 to 1.75.		
Mixed or low quality legume hay	5 to 7.	Grain	12 to 15.
		Protein supplement	1 to 1.5
Grain	13 to 16	Mixed hay	2 to 4.
Protein supplement	2 to 2.5.	Corn or sorghum silage	14 to 18.
Grass hay	5 to 7.		
		Grain	12 to 15.
Corn and cob meal	14 to 17.	Protein supplement	2 to 2.5.
Protein supplement	1 to 2.	Grass hay	3 to 5.
Mixed hay	4 to 6.	Corn or sorghum silage	14 to 18.
		Ground snapped corn	13 to 17.
Ground snapped corn	16 to 18.	Protein supplement	2 to 2.5.
Protein supplement	2 to 2.5.	Corn or sorghum silage	12 to 16.
Grass hay	3 to 5.		
		Corn	3.75.
Ground snapped corn	18 to 20.	Barley	3. 75.
Protein supplement	2 to 2.5.	Cottonseed meal	1.00.
Peanut hay	3 to 5.	Wet beet pulp	32.65.
		Alfalfa	9.78.

See footnote at end of table.

TABLE 4.—*Examples of beef cattle rations when cattle are on a full feed* [1]—Continued

STEERS—INITIAL WEIGHT 800 TO 900 POUNDS

Dry rations		Rations with silage	
Grain	16 to 18.	Grain	12 to 16.
Legume hay	6 to 8.	Protein supplement	1.25 to 1.75.
		Legume hay	1 to 3.
Grain	13 to 17.	Corn or sorghum silage	16 to 20.
Protein supplement	1.5 to 2.0.		
Mixed hay	7 to 9.	Grain	12 to 16.
		Protein supplement	3.0 to 2.5.
Grain	13 to 17.	Grass hay	3 to 5.
Protein supplement	1.5 to 2.0.	Corn or sorghum silage	16 to 20.
Grass hay	7 to 9.		
		Ground snapped corn	15 to 17.
Ground snapped corn	14 to 18.	Protein supplement	2.75 to 3.25.
Protein supplement	3.0 to 3.5.	Corn or sorghum silage	16 to 18.
Cottonseed hulls	6 to 8.		
		Milo	12.6.
		Soybean meal	2.0.
		Sorghum silage	35 to 40.
		Milo	12.6.
		Soybean meal	0.9.
		Molasses	3.0.
		Urea	0.2.
		Sorghum silage	35 to 40.

[1] The quantities of feed given in the rations listed represent averages for the entire feeding period. Feed allowed the last half of the feeding period would be more, and the first half less, than indicated. The proportion of roughage also normally changes during the feeding period, being higher at the beginning and lower toward the end.

1. Corn, barley, or sorghum grain can for practical purposes be used interchangeably although gains may not be quite as efficient on barley or sorghum. Rolled wheat is an excellent feed when fed up to half the grain ration at times when prices permit. When feeding corn-and-cob meal more protein supplement is needed than when feeding an equivalent amount of corn.

2. Dried beet pulp or dried molasses beet pulp can be substituted for up to half the grain when prices justify. Pulp is lower in protein than grains, so one-fourth to one-half pound more protein supplement is needed daily.

3. Cane, beet, or citrus molasses can be substituted for up to half the grain. However, it is best used at 5 to 8 percent of the mixed ration or 2 to 4 pounds per head daily. They are practically devoid of digestible proteins, so one-half to 1 pound more supplement is required daily if this substitution is made.

4. Up to half or even more of the roughage (dry-matter basis) in any ration as given can be replaced with low-quality roughages such as corncobs, cottonseed hulls, or cereal straws, provided increased protein, mineral, and vitamin supplements are provided.

5. Low-quality materials such as those mentioned above can be used

for the entire roughage allowance, but performance is likely to be reduced somewhat and a complex supplement is advisable.

6. Levels of good-quality roughage, up to at least one-half of the ration (dry basis), with concentrates can be used with relatively little reduction in rates of gain. This may be desirable if roughage is cheap in relation to concentrates, with lower-grade cattle, or if they are to be sold on a market where only a small premium will be paid for high finish.

7. Roughage levels can be considerably increased and concentrates reduced in case of low-grade cattle being fed for cheap gains rather than for high finish. Protein levels should be watched closely where some low-quality roughages are fed.

BALANCING RATIONS

The foregoing discussions have necessarily involved some approximations and application of "rules of thumb." Material in tables 6 and 7 makes it possible to compute more precisely the feed combinations which will best meet animal needs. If the composition of a feed not listed is known, it can be compared to that of listed feeds, at least some of which are likely to be familiar to the feeder.

Balancing a ration involves finding a combination of feeds that will supply the required nutrients for an animal of a given weight. For example, *the daily requirements* (table 6) of an 800-pound yearling finishing steer are:

Dry matter	lb.	19.8
Digestible protein	lb.	1.6
Total digestible nutrients	lb.	14.3
Calcium	lb.	.044
Phosphorus	lb.	.044
Carotene	mg.	45

A daily ration of 15.5 pounds of corn-and-cob meal, 1.5 pounds of cottonseed meal, and 5.0 pounds of mixed clover-timothy hay provides nutrients as shown in table 5 (computed from feed composition as given in table 7).

TABLE 5.—*Daily ration suitable for an 800-pound finishing steer*

[Trace mineralized salt should be available at all times]

Feed	Weight of feed	Weight of dry matter in feed	Digestible protein	Total digestible nutrients	Calcium	Phosphorus	Carotene
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Milligrams*
Corn-and-cob meal	15.5	13.2	.84	11.3	.0062	.0341	0
Cottonseed meal	1.5	1.4	.52	1.1	.0027	.0172	0
Mixed hay	5.0	4.4	.24	2.6	.0345	.0080	[1] 50
Total	22.0	19.0	1.60	15.0	.0434	.0593	[1] 50

[1] Approximate.

TABLE 6.--*Daily nutrient requirements of finishing beef cattle* [1]

Feeding system and body weight (pounds)	Daily nutrients per animal [2]							
	Dry matter	Total protein	Digestible protein	Total digestible nutrients	Calcium	Phosphorus	Carotene [3]	Vitamin A [3]
Wintering beef calves to gain about 1 pound daily	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Milligrams*	*U.S.P. units*
400	9.9	1.1	0.7	6.0	0.035	0.026	25	10,000
500	11.7	1.3	.8	7.0	.035	.026	30	12,000
600	13.5	1.4	.8	8.0	.035	.026	35	14,000
Fattening calves finished as short yearlings								
400	10.8	1.3	1.0	8.0	.044	.033	25	10,000
600	14.4	1.8	1.3	10.9	.044	.037	35	14,000
800	18.0	2.0	1.5	13.6	.044	.040	45	18,000
1,000	19.8	2.2	1.6	15.0	.044	.044	55	22,000
Fattening yearling cattle								
600	16.2	1.8	1.4	11.7	.044	.037	35	14,000
800	19.8	2.2	1.6	14.3	.044	.044	45	18,000
1,000	23.4	2.6	2.0	16.9	.044	.053	55	22,000
1,100	24.3	2.7	2.0	17.6	.044	.055	60	24,000
Fattening 2-year-old cattle								
800	21.6	2.4	1.8	14.9	.044	.048	45	18,000
1,000	24.3	2.7	2.0	16.7	.044	.055	55	22,000
1,200	26.1	2.9	2.2	18.0	.044	.057	65	26,000

[1] Based on—
National Academy of Sciences-National Research Council publication No. 579; and Morrison, F. B. and associates. *Feeds and Feeding.* The Morrison Printing Co. Clinton, Iowa. 1959.
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[2] Amounts given should be considered as approximate averages with variations of 5 to 10 percent below these amounts not expected to seriously depress performance. If cattle can be induced to eat more feed than indicated in the table, gains will be greater. This will depend on palatability of specific feeds being fed.

[3] Carotene and vitamin A are alternatives, since cattle convert carotene to vitamin A. Vitamin A requirements may be considerably higher than shown here, and available carotene may not be well utilized with certain silages grown on highly fertilized soil and by cattle on very high-concentrate rations.

TABLE 7.—*Composition of some feeds used in beef cattle finishing* [1]

Feeding stuff	Total dry matter	Total protein	Digestible protein	Total digestible nutrients	Fiber	Calcium	Phosphorus	Carotene
Carbonaceous Concentrates								
Barley:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Milligrams*[2]
Pacific Coast States	89. 9	8. 7	6. 9	78. 8	5. 7	0. 06	0. 33	----------
Other States	89. 4	12. 7	10. 0	77. 7	5. 4	. 06	. 40	----------
Beet pulp, dried	91. 2	8. 8	4. 1	68. 7	19. 6	. 69	. 08	----------
Beet pulp, molasses dried	92. 2	8. 9	5. 9	72. 4	15. 2	. 57	. 07	----------
Citrus pulp, dried	90. 0	6. 2	2. 7	74. 9	11. 6	2. 04	. 15	----------
Corn:								
Shelled, No. 2 dent	85. 0	8. 7	6. 7	80. 1	2. 0	. 02	. 27	----------
Corn-and-cob meal	86. 1	7. 4	5. 4	73. 2	8. 0	. 04	. 22	----------
Ground snapped corn	89. 3	7. 8	4. 8	69. 1	10. 5	----------	----------	----------
Molasses:								
Cane, or blackstrap	73. 4	3. 0	0	53. 7	0	. 66	. 08	----------
Beet	80. 5	8. 4	4. 4	60. 8	0	. 05	. 02	----------
Citrus	70. 4	4. 1	0	53. 6	0	1. 08	. 08	----------
Oats:								
Pacific Coast States	91. 2	9. 0	7. 0	72. 2	11. 0	----------	----------	----------
Other States	90. 2	12. 0	9. 4	70. 1	11. 0	. 09	. 33	----------
Sorghum grain:								
Combine types	89. 6	10. 8	8. 4	79. 9	2. 3	. 02	. 32	----------
Atlas	89. 1	11. 3	8. 8	80. 0	2. 0	----------	----------	----------
Wheat, average all types	89. 5	13. 2	11. 1	80. 0	2. 6	. 04	. 39	----------
Protein Supplements								
Corn distillers dried grains	92. 3	27. 1	19. 8	82. 7	9. 2	. 09	. 37	----------
Cottonseed meal: [3]								
Expeller process	92. 7	41. 4	34. 4	73. 4	11. 0	. 18	1. 15	----------
Solvent process	91. 4	41. 6	34. 5	66. 1	10. 7	. 15	1. 10	----------

See footnotes at end of table.

TABLE 7.—*Composition of some feeds used in beef cattle finishing* [1]—Continued

Feeding stuff	Total dry matter	Total protein	Digestible protein	Total digestible nutrients	Fiber	Calcium	Phosphorus	Carotene
Protein Supplements—Continued								
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Milligrams*[2]
Linseed meal:								
Expeller process, all analyses	90. 9	35. 3	28. 4	76. 3	8. 9	. 44	. 89	----------
Solvent process	90. 9	35. 1	30. 7	71. 0	9. 3	. 40	. 83	----------
Peanut meal:								
Expeller process	92. 0	45. 8	41. 7	80. 2	12. 6	. 17	. 57	----------
Solvent process	91. 5	47. 4	43. 1	74. 3	14. 9	. 20	. 65	----------
Soybean meal:								
Expeller process	89. 7	43. 8	36. 8	77. 0	5. 9	. 27	. 63	----------
Solvent process	89. 3	45. 8	42. 1	77. 2	5. 9	. 32	. 67	----------
Wheat bran	90. 1	16. 4	13. 3	66. 9	10. 0	. 13	1. 29	----------
Dry Roughages								
Alfalfa hay	90. 5	15. 3	10. 9	50. 7	28. 6	1. 47	. 24	27. 7
Alfalfa meal, dehydrated	92. 7	21. 1	16. 0	57. 2	17. 5	1. 69	. 25	47. 4
Alfalfa and bromegrass hay	89. 2	11. 8	7. 6	47. 9	32. 5	. 77	. 20	12. 5
Atlas sorghum fodder	75. 1	5. 3	2. 9	45. 0	16. 7	----------	----------	19. 8
Bermudagrass hay, good	90. 5	7. 1	3. 6	44. 2	25. 9	. 37	. 19	29. 5
Bermudagrass hay, N fertilized	90. 5	9. 2	6. 3	50. 8	27. 8	----------	----------	----------
Bluestem hay	86. 6	5. 4	1. 7	39. 2	30. 2	----------	----------	16. 6
Bromegrass hay, smooth	88. 8	10. 4	5. 3	49. 3	28. 2	. 42	. 19	16. 7
Clover hay, alsike	88. 9	12. 1	8. 1	53. 2	27. 0	1. 15	. 23	84. 8
Clover hay, red	88. 3	12. 0	7. 2	51. 8	27. 1	1. 28	. 20	16. 7
Clover and timothy hay, 30- to 50-percent clover	88. 1	8. 6	4. 7	51. 0	30. 3	. 69	. 16	7. 2
Corn cobs, ground	90. 4	2. 3	0	45. 7	32. 1	. 11	. 04	----------
Corn fodder, well eared, very dry	91. 1	7. 8	3. 8	58. 8	27. 1	. 27	. 16	----------
Corn fodder, drought stricken, no ears	85. 0	10. 8	3. 8	46. 1	25. 7	----------	----------	----------
Corn stover (ears removed), very dry	90. 6	5. 9	2. 1	51. 9	30. 8	. 54	. 09	----------
Cottonseed hulls	90. 8	3. 9	0	43. 7	45. 0	. 13	. 06	----------
Hagari fodder	86. 3	6. 1	3. 2	52. 4	18. 2	. 27	. 16	----------

Johnson grass hay	90. 2	6. 5	2. 9	50. 3	30. 5	. 87	. 26	16. 8
Lespedeza hay, all analyses	90. 0	13. 1	5. 6	45. 1	26. 9	. 96	. 18	21. 3
Oat hay	88. 1	8. 2	4. 9	47. 3	28. 1	. 21	. 19	45. 8
Oat hulls	92. 8	4. 6	1. 5	31. 7	29. 2	. 20	. 10	----
Oat straw	89. 8	4. 1	. 7	44. 8	36. 3	. 24	. 09	----
Orchardgrass hay, good	88. 7	8. 1	4. 2	49. 7	30. 4	. 27	. 18	15. 2
Pea straw, field	90. 2	6. 1	3. 2	42. 2	33. 1	----	. 10	----
Peanut hay, without nuts, good	90. 6	10. 0	5. 4	47. 3	23. 6	1. 12	. 13	22. 8
Prairie hay, western, cut in midseason	91. 3	6. 0	2. 0	45. 1	29. 7	. 33	. 12	14. 6
Soybean hay, good	88. 1	14. 6	9. 8	48. 6	28. 1	1. 10	. 22	16. 2
Timothy hay	89. 0	6. 6	3. 0	49. 1	30. 3	. 35	. 14	6. 2
Wheat hay	90. 4	6. 1	3. 3	46. 7	26. 1	. 14	. 18	50. 6
Wheat straw	92. 6	3. 9	. 3	40. 6	37. 0	. 15	. 07	----
Wheatgrass hay, crested, early cut	90. 0	9. 2	6. 5	50. 8	32. 2	----	----	----
Silages								
Alfalfa, not wilted, no preservative	24. 7	4. 1	2. 6	13. 5	8. 2	. 35	. 08	69. 3
Alfalfa, wilted, no preservative	36. 2	6. 3	4. 3	21. 5	11. 4	. 51	. 12	23. 4
Alfalfa, molasses, not wilted	26. 8	4. 1	2. 7	15. 4	8. 2	. 41	. 08	44. 1
Atlas sorghum	29. 7	2. 5	1. 4	18. 5	7. 4	. 12	. 06	10. 8
Beet pulp, ensiled	12. 0	1. 7	1. 0	9. 0	5. 2	----	----	----
Beet top, sugar, much dirt adhering	31. 6	3. 8	2. 5	14. 9	3. 9	. 31	. 07	16. 1
Corn, canning factory waste (husks, cobs, and waste ears)	22. 4	2. 0	1. 1	16. 1	5. 6	----	----	6. 1
Corn, dent, well matured	27. 6	2. 3	1. 2	18. 3	6. 7	. 10	. 07	20. 7
Clover, Ladino, and grass	29. 9	5. 4	3. 9	21. 4	7. 5	. 31	. 07	----
Fescue,tall	33. 5	4. 3	2. 6	20. 7	9. 6	----	----	----
Grass, considerable legumes, wilted	33. 3	5. 2	2. 9	19. 1	8. 8	----	----	----
Orcha dgrass	30. 0	3. 3	2. 0	19. 8	10. 2	----	----	76. 7
Pea vine from canneries	24. 5	3. 2	1. 9	14. 0	7. 3	. 32	. 06	85. 7
Sorghum, sweet	25. 4	1. 6	. 8	15. 2	6. 9	. 08	. 05	----

[1] Based on—
National Academy of Sciences–National Research Council publication No. 585; and
Morrison, F. B. and associates. *Feeds and Feeding.* The Morrison Printing Co. Clinton, Iowa. 1959.
Adapted with permission.

[2] No values are given where amounts are less than 2 mg./lb.

[3] Cottonseed meal is also made that ranges in protein content from about 36 percent to 45 percent.

The following is an example of a complete mixed finishing ration that can be self fed. Twenty-two pounds of this ration will supply approximately the same amounts of nutrients as those shown in table 5.

	Percent
Steamed rolled barley	36.0
Steamed rolled milo	36.0
Ground alfalfa hay	13.0
Blackstrap molasses	4.5
Cottonseed hulls	10.0
Trace mineralized salt	0.5
	100.0

This ration meets or exceeds the needs for digestible protein, total digestible nutrients, calcium, phosphorus, and carotene.

A balanced ration as computed should not be taken as the last word on what should be fed since feed intake may differ because of genetic makeup, quality and preparation of feeds, temperature, etc. Checking actual feed consumption against requirements will, however, give a feeder an excellent check on his cattle and his feeding program.

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